THE GENUS *ZONOSEMATA*, WITH NOTES ON THE CYTOLOGY OF TWO SPECIES (DIPTERA — TEPHRITIDAE)[1]

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The genus *Zonosemata* (Trypetinae, Trypetini) was established by Benjamin (1934) to include the type, *Trypeta electa* Say, and *Zonosema vittigera* Coquillett. The latter species he considered as possibly only a western race of *electa*. Both are recognized as distinct in this revision and two new species from Mexico and one from Jamaica are described.

Zonosemata is closely related to the Holarctic and Neotropical *Rhagoletis* Loew (including *Zonosema* Loew), the monotypic Nearctic *Rhagoletoides* Foote, the Neotropical *Rhagoletotrypeta* Aczél, and the Palearctic and Indian *Carpomyia* Rondani[2]. It shows particularly close affinities in habitus to certain Mexican and Neotropical *Rhagoletis,* such as *R. striatella, R. ferrugineus, R. lycopersella, R. ochraspis,* and others, some of which infest solanaceous fruits as do at least two species of *Zonosemata.* Cytologically the chromosomes of *Zonosemata* also bear some resemblance to those of *R. striatella.* Furthermore, unlike other *Rhagoletis* species, the egg of *striatella* is stalked and somewhat like those of *Z. electa* (Fig. 26) and *Z. vittigera.* These similarities, coupled with the fact that four of the five species are from Mexico and Jamaica, suggest that *Zonosemata* probably originated in Central or possibly South America from some common ancestor with *Rhagoletis.* Further field work in these regions may therefore eventually clarify the relationships between these two genera.

BIOLOGY

The biology of *Z. vittigera* and *Z. electa* has been discussed in some detail by several authors (Peterson 1923, Benjamin 1934, Burdette 1935, Cazier 1962, and Foott 1963). Both species normally infest certain native species of horsenettle (*Solanum* spp., *Solanaceae*).

[1]Published with the aid of a grant from the Committee on Evolutionary Biology, Department of Biology, Harvard University. *Manuscript received by the editor, August 30, 1965.*

[2]The presence of minute ocellar bristles in *Carpomyia* is the only character that effectively separates this genus from *Rhagoletis.* This character is of doubtful importance and *Rhagoletis* may eventually fall into synonymy with *Carpomyia* (for detailed discussion see Bush 1966).

Since 1921, however, *electa* has become a serious pest of peppers and eggplants in the eastern United States. Recently it was found attacking these plants as far north as southwestern Ontario (Foott 1963). The hosts of the three new species are not known, but they may also be expected to infest the fruits of solanaceous plants.

There is evidence that the pepper and horsenettle populations, at least in Ontario, have become somewhat ecologically isolated from each other. Foott (1963) noted that larvae from horsenettle emerge later and are considerably smaller than those emerging from peppers. He offered three possible explanations for this observation: microclimatic conditions were different for the two hosts; nutritive qualities of the fruits varied; earlier availability of pepper fruits allowed expansion of the early emerging fly population. As pointed out by Bush (1966), the third possibility would establish allochronically isolated populations on different hosts and permit divergence to progress rapidly in the absence of gene flow from the parent population. This could result in the formation of two distinct host races. A careful study of these populations would be extremely interesting as little is known about the formation of host races and species in phytophagous insects.

CYTOLOGY

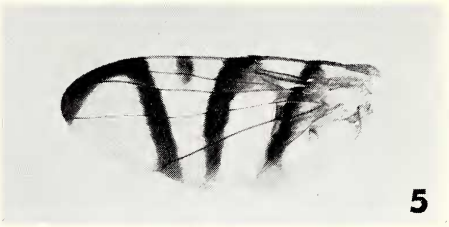
Mitotic configurations in the larval brain and adult testes were examined in *Z. electa* and *Z. vittigera.* Tissue was pretreated in a saturated aqueous solution of coumarin for 5 - 8 minutes, fixed and stained in proprionic orcein for 5 minutes, and squashed in a drop of stain following the method of Bush (1962). Pretreatment of the tissue with coumarin was necessary to produce well flattened metaphase plates and to locate the kinetichores.

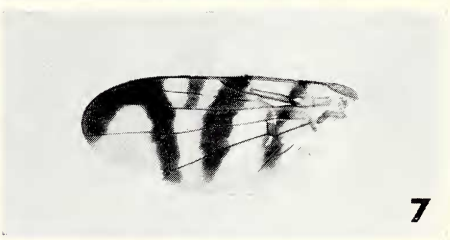
The karyotypes of both species are indistinguishable. In the male there are five pairs of very small metakinetic autosomes and a heteromorphic pair of extremely long acrokinetic and heterochromatic sex chromosomes (Fig. 1). Following coumarin pretreatment the chromatids of the X chromosome at metaphase are usually joined only at their extreme ends forming an oblong ring (Fig. 1, X). The chromatids of the shorter Y chromosome are usually closely approximated over much of their length and form a figure

Explanation of Plate 22

Figs. 1-3. Mitosis in neuroblast cells of *Zonosemata electa:* (1) metaphase; (2) prophase; (3) anaphase.

Figs. 4-8. Right wings of *Zonosemata* spp.: (4) *electa,* N. J., U. S. A.; (5) *vittigera,* Texas, U. S. A.; (6) *cocoyoc,* paratype, Morelos, Mex.; (7) *minuta,* type, Jamaica, W. I.; (8) *vidrapennis,* paratype, Mexico, Mex.





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eight (Fig. 1, Y). At prophase (Fig. 2) the X chromosomes are greatly elongated and are associated with a nucleolar organizer. At late anaphase (Fig. 3) the chromatids of the sex chromosomes are still in contact on the metaphase plate while the fully disjoined autosomes have reached the poles. In both sexes a large heterochromatic irregular-shaped body is always visible in the nucleus during interphase. However, it is not clear whether this represents only one or both sex chromosomes. Both the autosomes and the sex chromosomes have a fuzzy appearance during all stages of division, suggesting that some genetic activity may be in progress even during cell division. The polytene chromosomes of the salivary gland, gut, and Malpighian tubules were checked and found unsuitable for detailed analysis.

Zonosemata Benjamin

Spilographa Loew (in part), 1873, Smith. Misc. Coll. 256: 244, 336.
Zonosema Coquillett, 1899, Jour. N.Y. Ent. Soc. 7: 261.
Phorellia Hendel (in part), 1914, Abh. u. Ber. Zool. Mus. Dresden (1912) 14: 28.
Zonosemata Benjamin, 1934, U.S. Dept. Agri. Tech. Bull. 401: 17-18. [Type of genus, *Trypeta electa* Say, location unknown, apparently lost[3]; type locality: Indiana]. — Aczél, 1951, Acta zool. Lilloana 9: 214. — Aczél, 1954, Dusenia 5: 152-153.

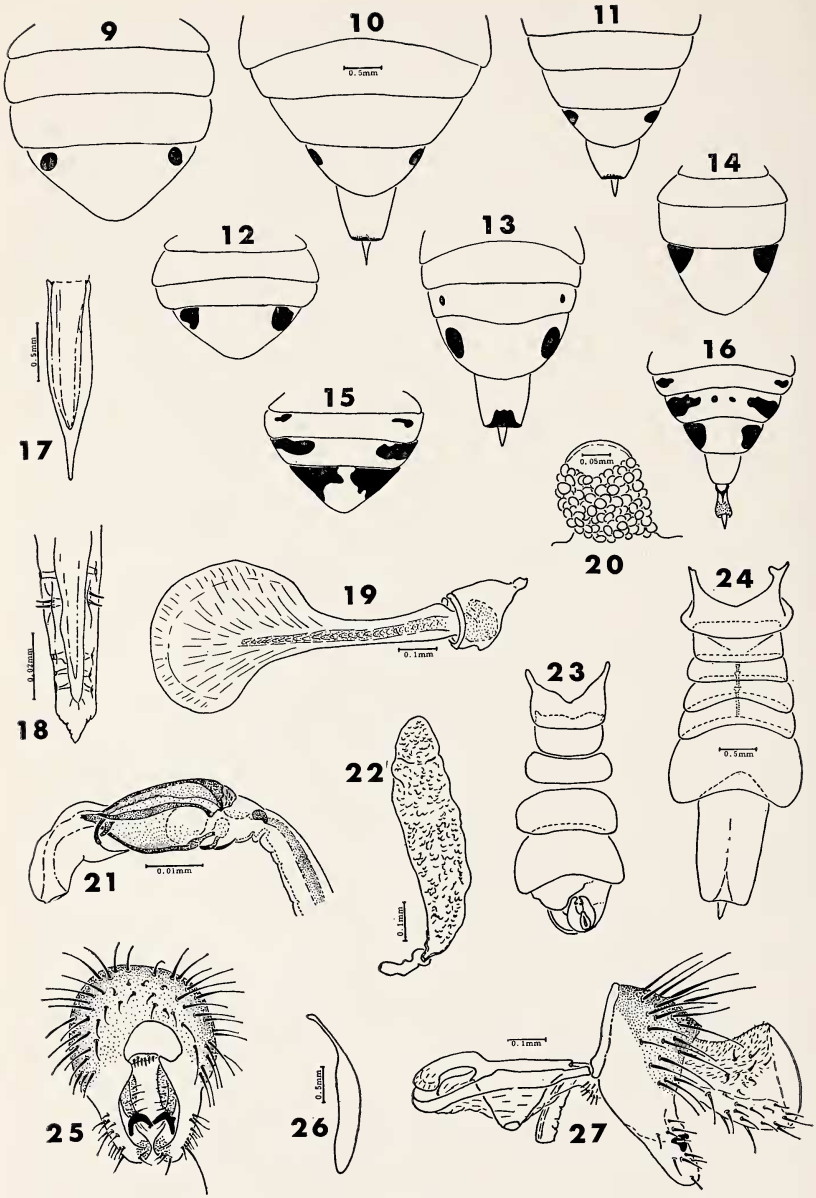
Further details on the nomenclatorial history of this genus may be found in Benjamin (1934) and Stone (1951).

GENERIC DIAGNOSIS. *Zonosemata* may be distinguished from other members of the tribe Trypetini by the following combination of characters:

1. Predominantly yellow with black maculations, a cream colored notopleural stripe and brown crossbands on the wing.
2. Dorsocentrals located closer to a line drawn between postalars than to anterior supraalars.
3. One pair of well developed outer scapular bristles, inner pair absent or if present (rarely) then minute.
4. Sex chromosomes diffuse, much elongated, heterochromatic and heteropycnotic; autosomes very small and diffuse.
5. Surstyli blunt, short and broad; not greatly elongated beyond prensisetae.
6. *Usually* four pairs of lower fronto-orbital bristles.
7. Dorsum lacking pollinose microtrichia.
8. Larvae with minute poorly sclerotized stomal guard hooks.

[3]Although no type could be located for *electa,* Say's original description is clear enough to leave no doubt as to the identification of the type species. A neotype was not designated pending a more thorough search for the type.

GENERIC DESCRIPTION. *Head* (Fig. 30): subquadrate in profile; about 1.1 times wider than high; all regions, including palps and mentum, light yellow to yellowish-orange; ocellar triangle light brown to brownish-black; vertex measured across anterior margin of ocellar plate, narrower than maximum width of eye; eye about 1.5 times higher than wide; frons convex in profile, prominent at antennae, slightly wider at vertex than at antennae; antennae .5 - .6 length of face; third segment with sharp awl-shaped tip, more than twice length of second; artista black or dark brown, pubescent, grading to yellow at base; face minutely pubescent. Genae moderately narrow, .23-.26 height of head. Postcranial region and head slightly concave; foveae and carina moderately developed; epistome slightly upturned; postgenae bulging. Usually four pairs convergent black fronto-orbitals, occasionally only three pairs or with one or two extra bristles on one side or both; two pairs black reclinate divergent upper fronto-orbitals, upper approximately two-thirds length of lower; ocellars strongly proclinate, divergent, approximately same length as upper fronto-orbitals. Comb translucent yellow. Outer verticals black, about two-thirds length black inner verticals; post-orbitals yellow, short; genal bristles variable, yellow or black when present, occasionally undifferentiated; yellow gular bristle weak or undifferentiated. *Thorax:* entirely yellow or with brown and black maculations; halteres yellow. Dorsum and scutellum covered with short decumbent yellow or black setae, lacking any trace of pollinose microtrichia. Normally one pair outer scutellars, rarely one or two minute scapulars present; dorsocentrals in line or slightly before line drawn between posterior supraalars; two mesopleurals; all other bristles normal for Trypetinae. *Legs:* all segments yellow except for black shading along posterior surface of metathoracic tibia. Prothoracic femur with one posterior-ventral and two dorsal rows of stout bristles. Mesothoracic tibia with row of three to five short semierect bristles on posterior surface. Metathoracic tibia with row of short semierect bristles along posterior-lateral surface. *Wing:* pattern consisting of transverse brown crossbands; R_1 setulose over entire length including node; R4+5 setulose; usually one to three setae dorsally at junction of R4+5 and R2+3; anal cell drawn out to point along Cu2+2nd A. *Abdomen:* tergites covered with fine long decumbent setae; long black bristles along posterior and lateral margins of tergites III-V in male and III-VI in female (Fig. 24) with well developed internal apodemes. Sternite VI about .55 length of ovipositor sheath. Sternites of male (Fig. 23) without well developed internal apodemes. *Genitalia: male* —-epandrium globose,



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usually black, covered with long bristles; surstyli short with prensisetae (or spurs) subterminal (Fig. 25); genital ring circular, without apodemes (Fig. 27); ejaculatory apodeme fan-shaped (Fig. 19). Vesica of aedeagus (Fig. 21) tubular, without convolutions or appendages. *Female* — ovipositor sheath approximately same length as tergite IV in dorsal view. Ovipositor (Fig. 17) short, margins slightly convex with minute trifurcate tip and two pairs of subterminal minute setae (Fig. 18); two elongate cylindrical spermathecae covered with irregularly shaped minute scale-like papillae (Fig. 22); two elongate accessory glands. Ventral receptacle as in Fig. 20, without central spine as in *Rhagoletis*. *Egg:* micropyle end elongated into stalk (Fig. 26).

KEY TO THE GENUS ZONOSEMATA

The characters most readily used to distinguish the various species in this genus are found in the wing pattern and distribution of black maculations on the body. Other than size, little variation was noted in such structural characters as the male and female genitalia and the number, color, and position of major chaetae.

1. A pair of black presutural spots on the dorsum (Fig. 36) and a black spot or stripe on the sternopleuron (Fig. 35). Host: *Solanum eleagnifolium* ..... *vittigera* Coquillett (SW U.S.A., N Cent. Mex.)

   No distinct black spots before the transverse suture or on the sternopleuron 2

2. Last three segments of the abdomen each with large, irregularly shaped dark brown to black spots (Figs. 15-♂, 16-♀); dorsum with broad U-shaped maculation with unforked arms (Fig. 33). Host unknown ..... *minuta* n. sp. (Jamaica)

   Pair of well developed spots on last one or two segments (i.e., Figs. 9-10); black U-shaped maculation on dorsum reduced or

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EXPLANATION OF PLATE 23

Figs. 9-16. Abdomen of *Zonosemata* spp., dorsal view: (9) ♂ *electa,* N. J., U. S. A.; (10) ♀ *electa,* N. J., U. S. A.; (11) ♀ vittigera, Texas, U. S. A.; (12) ♂ *vittigera,* Texas, U. S. A.; (13) ♀ *cocoyoc,* Morelos, Mex.; (14) ♂ *vidrapennis,* type, Mexico, Mex.; (15) ♂ *minuta,* type, Jamaica, W. I.; (16) ♀ *minuta,* paratype, Jamaica, W. I.

Figs. 17-27. *Zonosemata electa,* N. J., U. S. A.: (17) ovipositor; (18) detail of ovipositor tip; (19) ejaculatory apodeme; (20) ventral receptacle; (21) aedeagus; (22) spermatheca; (23) ♂ sternites of abdomen; (24) ♀ sternites of abdomen; (25) posterior view of ♂ genitalia; (26) egg; (27) lateral view of ♂ genitalia showing details of fultella and genital ring.

absent; if present then usually with forked arms (i.e., Figs. 37-38) 3

3. Apical wing band recurved along R4+5 but not reaching subapical band, forming the letter P (Fig. 6); last two segments of abdomen each with pair of black spots (Fig. 13). Host unknown ..... *cocoyoc* n. sp. (Mexico)

Apical crossband forming the letter V; not recurved along R4+5; a single pair of black spots on last segment 4

4. Crossbands of wing narrow (Fig. 8); microtrichia lacking between medial and subapical crossbands in cells R_1, R_3, R_5 and 1st M_2; spot on last abdominal segment large, triangular shaped (Fig. 14). Host unknown ..... *vidrapennis* n. sp. (Mexico)

Crossbands of wing broad (Fig. 4); microtrichia present in all cells between medial and subapical crossbands; spot on last abdominal segment small, round (Figs. 9-10). Host: *Solanum* spp. ..... *electa* (Say) (E. U.S.A., SE Canada)

Zonosemata electa (Say)

Trypeta electa Say, 1829-30, Jour. Acad. Nat. Sci. Phil. 6: 185-186. [Type not examined, apparently lost[4]; type locality: Indiana]. — Osten Sacken, 1858, Smith. Misc. Coll., Art. 1, 3: 79. — Loew, 1862, Smith. Misc. Coll., Art. 1, 6: 58, 71. Stone, 1951, Proc. Ent. Soc. Wash. 53: 45-46.

Tephritis flavonotata Macquart, 1855, Dipt. Exot. Suppl. 5: 125. [Type not examined[5]; type locality: De l'Amerique septintrionale. Baltimore (in collection of J. E. Collin, Newmarket, England)].

Zonosema electa Coquillett, 1899, Jour. N. Y. Ent. Soc. 7: 261. — Phillips, 1923, Jour. N. Y. Ent. Soc. 31: 127-128, fig. 8.

Spilographa electa Loew, 1873, Smith. Misc. Coll. 256: 244, 336. — Snow, 1903, Kans. Univ. Quart. 11: 161. — Williston, 1905, Kans. Univ. Quart. 13: 307. — Peterson, 1923, N. J. Expt. Sta. Bull. 373: 1-23, pl. 1-3

Zonosemata electa Benjamin, 1934, U. S. Dept. Agri. Tech. Bull. 401: 19-20, fig. 15. — Burdette, 1935, N. J. Expt. Sta. Bull. 585: 3-24, pl. 1-3. — Phillips, 1946, Mem. Amer. Ent. Soc. 12: 96-98, 129, figs. 44, 89, 93, 191. — Anonymous, 1959, U. S. Dept. Agri., Agri. Res. Serv., Copp. Econ. Insect Rept. 9: 721-722. — Foote, 1960, Proc. Biol. Soc. Wash. 73: 114-116.

DIAGNOSIS. Excellent detailed descriptions of both larval and adult stages have been presented by Peterson (1923), Benjamin (1934),

[4]See foot-note, p. 310.

[5]Macquart's type has been discussed by Stone (1951) who has established its identity with certainty with the help of Mr. J. E. Collin.

and Phillips (1946) and will not be repeated here. Body and wing measurements are presented in Table 1. This predominantly yellow species can be distinguished by the following combination of characters: (1) large body size (Table 1); (2) absence of black markings before the transverse suture on the dorsum and on the sternopleuron (Figs. 29, 37); (3) yellow postscutellum; (4) presence of only a single pair of spots on the last segment of the preabdomen (Figs. 9-10); (5) crossbands of wing broad with medial and subapical bands joined along the posterior margin (Fig. 4); (6) microtrichia present between medial and subapical bands in cells R_1, R_3, R_5, and 1st M_2. Other morphological features of *electa* are illustrated as follows: genitalia (Figs. 17-22, 25, 27); sternites (Figs. 23-24); head (Fig. 30).

VARIATION. There is a great deal of individual variation in this species, particularly in the extent of black shading on the thorax and hind femora. Figs. 29 and 37 therefore represent only the most frequently encountered pattern in well-aged specimens whose color has had time to develop fully. The U-shaped pattern of the dorsum, for example, is often reduced to a small region along the sulcus between the dorsum and scutellum, or is entirely absent. There is also a tendency for individuals from Florida to be somewhat smaller than those from either the North or Texas. A few of the Florida specimens were as small as the average sized *vittigera*. Although most specimens had four pairs of lower fronto-orbitals, numbers ranging from three to as many as seven on one or both sides of the frons were not uncommon.

HOSTS. *Solanum carolinense* Linn., *S. aculeatissimum* Jacq., *S. melongena* Linn., *Capsicum annum* Linn., and infrequently *Lycopersicum esculentum* Mill. (Peterson 1932, Benjamin 1934).

PARASITE. *Opius sanguineus* (Ashmead) (Cazier 1962).

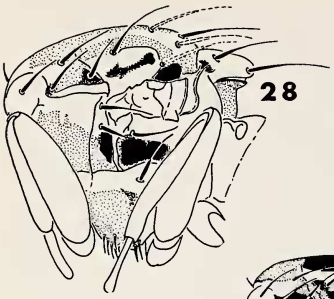
DISTRIBUTION (Map 1). This species ranges from central Florida north to Massachusetts, southern Ontario, southern Illinois, eastern Kansas, and northeastern Texas. The range of *electa* apparently overlaps that of *vittigera* in the transition zone of eastern Texas as far south as Brownsville (see also Foote 1960).

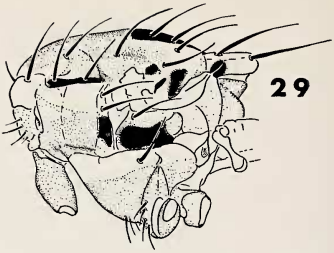
Zonosemata vittigera (Coquillett)

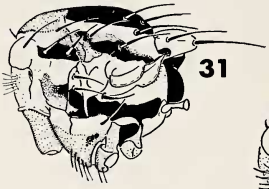
Zonosema vittigera Coquillett, 1899, Jour. N. Y. Ent. Soc. 7: 261. [Lectotype by present designation; locality: Eagle Pass, Texas; (J. Cram coll.) (USNM, type no. 4398)].

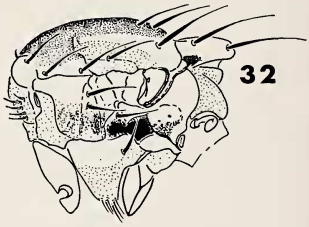
Spilographa vittigera Aldrich, 1905, Smith. Misc. Coll. 46: 604.

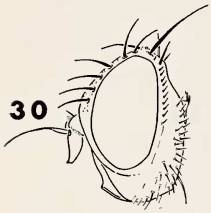
Zonosemata vittiigera Benjamin, 1934, U. S. Dept. Agri. Tech. Bull. 401: 18, fig. 15. —Phillips, 1946, Mem. Amer. Ent. Soc. 12: 100-101, figs.

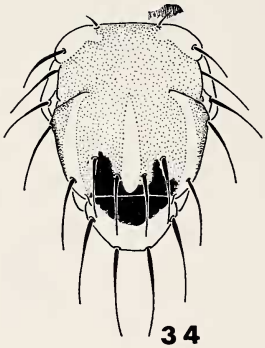


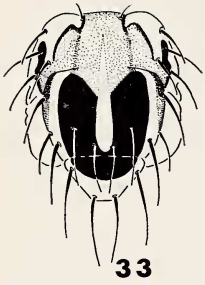


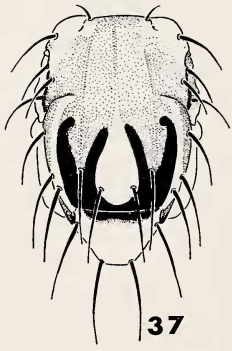


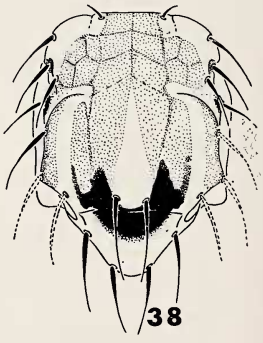












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43, 88, 98, 190. — Aczél, 1954, Dusenia 5: 152-157, figs. 19-27. — Foote, 1960, Proc. Biol. Soc. Wash. 73: 114-116.

Zonosemata variegata[6] Aczél, 1954, Dusenia 5: 162, 164 figs. 19-27; estampa II. C (nomen nudum).

DIAGNOSIS. Detailed descriptions of this species have been presented by Aczél (1954) (adult), and Phillips (1946) (larva). Body and wing measurements are presented in Table 1. *Z. vittigera* can be distinguished readily from all other members of this genus by the presence of a pair of black dots before the transverse suture (Fig. 36), and by the presence of a black stripe or distinct spot on the sternopleuron (Fig. 35). The abdomen has a pair of baso-lateral spots on the last segment in both sexes (Figs. 11, 12). Occasional individuals may also have small brown spots on the penultimate segments. The wing pattern of *vittigera* (Fig. 5) is very similar to that of *minuta* (Fig. 7), but usually can be distinguished from that of *electa* (Fig. 4) by the fact that the medial and subapical bands are joined in the latter species.

VARIATION. The intensity of the black pigmentation of the presutural spots varied a great deal in the specimens available for study, particularly in those from Texas. Many of these specimens have the presutural and sternopleural black spots generally diluted and the postscutellum often predominantly yellow. Hybridization beween *electa* and *vittigera* could account for the reduction in the degree of black coloration in the latter species. However, this seems unlikely as there is no indication of introgression, such as a tendency toward reduction in size or an increase in the intensity or distribution of

[6]Although Aczél used the name *vittigera* throughout the text of his 1954 paper, he labelled the accompanying illustrations *variegata*. I have also examined specimens bearing the name *variegata* on a type label in Aczél's handwriting in the USNM collection. Dr. Alan Stone of the USNM found Aczél's manuscript species *variegata* to be synonymous with Coquillett's *vittigera* after comparing the types at Aczél's request (from correspondence between Stone and Aczél, 1952, USNM). Aczél therefore apparently made the necessary change in the text but failed to do so for the plate before the paper was published.

EXPLANATION OF PLATE 24

Figs. 28-29, 31-32, 35. Thorax, lateral view, *Zonosemata* spp.: (28) ♀ *cocoyoc,* paratype, Morelos, Mex.; (29) ♂ *electa,* N. J., U. S. A.; (31) ♂ *minuta,* type, Jamaica, W. I.; (32) ♂ *vidrapennis,* paratype, Mexico, Mex.; (35) ♂ *vittigera,* Texas, U. S. A.

Figs. 33-34, 36-38. Thorax, dorsal view, *Zonosemata* spp.: (33) ♂ *minuta,* type, Jamaica W. I.; (34) ♂ *vidrapennis,* paratype, Mexico, Mex.; (36) ♂ *vittigera,* Texas, U. S. A.; (37) ♂ *electa,* N. J., U. S. A.; (38) ♀ *cocoyoc,* paratype, Morelos, Mex.

Fig. 30. Head, *electa* ♂, N. J., U. S. A.

Species	n	HL	HW	HH	TL	WW	WL	OL
electa								
♂	20	1.47± .03	2.31± .04	2.10± .04	3.40± .04	2.56± .05	4.99± .09	
		1.16–1.64	2.00–2.56	1.88–2.44	3.00–3.96	2.24–2.92	4.28–5.68	
♀	20	1.51± .02	2.37± .03	2.11± .03	3.47± .05	2.69± .05	5.13± .07	1.67± .03
		1.28–1.72	2.00–2.60	1.80–2.32	2.92–3.84	2.32–3.12	4.56–5.80	1.44–2.16
vittigera								
♂	20	1.19± .03	1.84± .03	1.67± .03	2.49± .06	1.86± .03	3.83± .07	
		.96–1.32	1.56–2.04	1.40–1.92	2.04–2.84	1.60–2.08	3.20–4.36	
♀	20	1.20± .03	1.90± .04	1.70± .05	2.53± .07	1.95± .05	4.00± .08	1.12± .02
		.92–1.36	1.52–2.10	1.24–2.00	1.84–2.96	1.48–2.24	3.00–4.52	1.00–1.28
vidrapennis								
♂ (Holotype)	1	1.12	1.88	1.60	2.80	2.32	4.68	
minuta								
♂ (Holotype)	1	1.04	1.76	1.60	2.40	1.60	3.48	
♀	1	1.04	1.76	1.60	2.24	1.64	3.60	
cocoyoc								
♀ (Holotype)	1	1.28	2.12	1.90	3.00	2.52	5.08	1.64
♀ (Paratype)	1	1.36	2.24	2.04	3.16	2.66	5.16	

Table 1. Body and wing measurements of *Zonosemata*. Figures represent mean, standard error, and range in mm. HL — head length; HW — head width; HH — head height; TL — thorax length; WL — wing length; WW — wing width; OL — ovipositor length.

black maculation, in the sympatric specimens of *electa* examined from Texas. Some specimens of *vittigera* were reared and appear to be teneral. This could account for their lack of intense black maculations.

Four specimens which appear to be *vittigera* have been examined, each bearing the label 'N.J., Sept. 7-8,' a locality well outside the normal range of this species. Some of these specimens have spots on both the penultimate and last segments. This has been noted in only a few other representatives of this species from Mexico. In all other respects, such as size, wing pattern, and body coloration, they resemble *vittigera*. Without host data or additional information concerning the collection of these specimens, it is impossible to decide if they represent a distinct species. They are therefore tentatively being treated as an adventive of *vittigera* to New Jersey until further information becomes available.

HOST. *Solanum eleagnifolium* Cav. (Aczel 1954, Foote 1960, Cazier 1962).

PARASITE. *Opius sanguineus* (Ashmead) (Cazier 1962).

DISTRIBUTION (Map 1). This species ranges from just north of Mexico, D.F. in the central highlands of Mexico and the southwest tip of Oklahoma to northeastern Texas. Its host plant now occurs as on advent in Indiana, Illinois, Ohio, and Florida, but *vittigera* has never been recorded from these areas. A single specimen from San Francisco, California has been examined, but was collected in a Santa Fe Pullman and therefore is not recorded on Map 1.

Zonosemata cocoyoc new species

TYPES. Holotype ♀, Cocoyoc, MORELOS, Mexico, 8-VIII-56; Trampa Cabo; (O. Hernandez) (USNM, type no. 68111). Paratype ♀, same data as holotype (USNM).

DIAGNOSIS. *Zonosemata cocoyoc* can be easily distinguished from other members of the genus by the wing pattern in which the apical and subapical bands form a letter P. The apical band extends along vein R4+5, but does not reach the subapical band (Fig. 6). The reduced black coloration of the thorax (Fig. 6). The reduced black coloration of the thorax (Figs. 28, 38) and the presence of paired spots on tergites V and VI of the female (Fig. 13) will also help to identify this species. The male is unknown.

DESCRIPTION. Body and wing measurements in Table 1. *Head* ♀: indistinguishable in shape from *electa;* all regions, including mentum and palps, golden yellow to light yellow except black ocellar triangle. Genal and gular bristles yellow, undifferentiated from other setae; all other bristles normal and black. *Thorax* (Figs. 28, 38): base color golden yellow; notopleural and sternopleural stripes and light region of dorsum and scutellum ivory. Black shading reduced on dorsum and pleural regions as figured. Postscutellum mostly golden yellow with some black shading along medial line and dorsal margin. *Legs:* normal color and complement of bristles for genus. *Wing* (Fig. 6): medial and basal bands joined by a faint infuscated area in cell R_1. Apical band joined to subapical band on costa and recurved along vein R4+5, but not reaching subapical band. Microtrichia present in all cells between medial and subapical crossbands; absent in cells between medial and basal crossbands from costa to M_3+Cu_1. *Abdomen* (Fig. 13): base color yellow, covered with long black decumbent setae. Tergite V with small pair and tergite VI with large pair of black spots. *Genitalia:* ovipositor sheath golden yellow, darker than rest of abdomen. Ovipositor tip similar to *electa.*

HOST. Unknown; captured in a McPhail fermenting lure glass trap.

DISTRIBUTION (Map 1). Known only from the type locality.

Zonosemata minuta new species

TYPES. Holotype ♂, Montego Bay [Jamaica], 2-VII-57, (J. W. Boyes) (USNM, type no. 68112). Paratype ♀, same data as type (USNM).

DIAGNOSIS. This small species can be easily identified by the distinctive U-shaped black pattern on the dorsum (Fig. 33), the

Map 1. Distribution of *Zonosemata*

dark border around the humeral callus, and the presence of black spotting on the last three segments of the abdomen in both male and female (Figs. 15-16).

DESCRIPTION ♂. Body and wing measurements in Table 1. *Head:* indistinguishable in shape from that of *electa* (Fig. 30); all regions including mentum and palps golden yellow except black ocellar triangle; post ocellars yellow or black; gular undifferentiated, genal and all other bristles black. *Thorax* (Figs. 31, 33): notopleural and sternopleural stripes and light areas of dorsum and scutellum yellow; dorsum and base of scutellum with broad dark brown to black U-shaped pattern; humeral callus in dorsal view emarginated with black; pleural regions with black stripe extending from lower half of mesopleuron to base of postscutellum; dark brown to black shading also present on lower half of sternopleuron. Postscutellum brownish-black. Dorsum and scutellum covered with short light yellow to brown decumbent setae. *Legs:* normal color and complement of bristles for genus. *Wing* (Fig. 7): crossbands broad; basal

band joined to medial band by faint infuscated area in cell R_1 (best seen in transmitted light); microtrichia present in all cells of wing. *Abdomen* (Fig. 15): golden yellow to light yellowish-brown covered with long black decumbent setae; tergite III with single pair of irregular shaped black spots; tergite IV with pair of elongated irregular bar-shaped markings; tergite V with large irregular triangular-shaped spots. *Genitalia:* exposed portion on type indistinguishable from *electa.*

Description of ♀: differs from male only in having more extensive black shading on thorax, legs, and abdomen, particularly on dorsum and metathoracic tibia. *Genitalia:* ovipositor tip exposed in paratype, similar to *electa.*

HOST. Unknown.

DISTRIBUTION (Map 1). Jamaica, West Indies. Known only from the type locality.

Zonosemata vidrapennis new species

TYPES. Holotype ♂, Oaxaca, OAXACA, Mexico, 16-IX-1933 (C.C. Plummer) (USNM, type no. 68113). Paratype ♂, entre Villa Guerrero y Tenanzingo, MEXICO, Mexico, 13-VIII-1961, sweeping (F. Pacheco), slide no. 110, G.L. Bush (USNM) (specimen badly damaged).

DIAGNOSIS. Differs from all other *Zonosemata* in having narrow wing bands and lacks the faint infuscated area joining the basal and medial crossbands in cell R_1 along vein R (Fig. 8). The short decumbent setae on dorsum are entirely black and the posterior margin of the dorsum and anterior margin of the scutellum show only a trace of the black horseshoe-shaped pattern (Fig. 34) normally found in other members of this genus. The pleural regions are almost entirely yellow except for black shading on the sternopleuron (Fig. 32). A pair of spots on the last abdominal segment are large and triangular-shaped (Fig. 14). This species is known only from two male specimens.

DESCRIPTION ♂. Body and wing measurements of type in Table 1. *Head:* indistinguishable in shape from that of *electa;* yellow to brownish-yellow except black ocellar triangle. Genal and gular bristles and setae on postgenae yellow; all other bristles black. *Thorax* (Figs. 32, 34): light brown to yellow; notopleural stripe, sternopleural stripe and light regions of dorsum, scutellum, and postscutellum golden yellow; small, ill-defined U-shaped black pattern on anterior margin of scutellum and posterior margin of dorsum in paratype, but almost absent in type. Dorsum and scutellum

covered with short black decumbent setae. Black shading on pteropleuron becoming diffuse on mesopleuron. *Legs:* normal complement of bristles; entirely yellow. *Wing* (Fig. 8): glassy in appearance; crossbands narrow; basal band not joined to medial band in cell R_1, and latter not joined to subapical band along posterior margin of wing in cell Cu_1. Microtrichia present in all cells between subapical crossband and apex of wing; absent from regions between basal and subapical crossbands except along posterior margins of wing and in cell R_1 between short intercalary band and subapical band. Basal two-thirds of $R4+5$ setulose. *Abdomen* (Fig. 24): base color brownish-yellow, colored with short black decumbent setae. Tergite V with pair of distinct triangular-shaped black spots on baso-lateral surface. *Genitalia:* indistinguishable from that of *electa.*

HOST. Unknown.

DISTRIBUTION (Map 1). Known only from the two localities listed above.

Acknowledgments

I would like to thank Mr. J. P. Reed of the New Jersey Agricultural Experiment Station, Rutgers University, and Mr. E. W. Johnson, U.S. Department of Agriculture, Brownsville, Texas for their assistance in locating suitable material for cytological studies.

Literature Cited

ACZEL, M.
1954. Generos y especies da la tribus Trypetini 4. El genero *Rhagoletotrypeta* y nuevas especies de *Tomoplagia* y de *Zonosemata* (Diptera, Tephritidae). Dusenia 5: 152-157.

BENJAMIN, F. H.
1934. Descriptions of some native trypetid flies with notes on their habits. U. S. Dept. Agri. Tech. Bull. 401: 1-96, figs. 1-44.

BURDETTE, R. C.
1935. The biology and control of the pepper maggot, *Zonosemata electa* Say. Trypetidae. N. J. Agri. Expt. Sta. Bull. 585: 3-31.

BUSH, G. L.
1962. The cytotaxonomy of the larvae of some Mexican fruit flies in the genus *Anastrepha* (Tephritidae, Diptera). Psyche 69: 87-101.
1966. The taxonomy, cytology, and evolution of the genus *Rhagoletis* in North America (Diptera, Tephritidae). Bull. Mus. Comp. Zool., in press.

CAZIER, M. A.
1962. Notes on the bionomics of *Zonosemata vittigera* (Coquillett), a fruit fly on *Solanum* (Diptera: Tephritidae). Pan-Pacific Ent. 38: 181-186.

Foote, R. H.
1960. Notes on some North American Tephritidae, with descriptions of two genera and two new species (Diptera). Proc. Biol. Soc. Wash. 73: 107-118.
Foott, W. H.
1963. The biology and control of the pepper maggot, *Zonosemata electa* (Say) (Diptera: Trypetidae) in southwestern Ontario. Proc. Ent. Soc. Ont. 93: 75-81.
Peterson, A.
1923. The pepper maggot, a new pest of peppers and eggplants. *Spilographa electa* Say. (Trypetidae). N. J. Agri. Expt. Sta. Bull. 373: 4-23.
Phillips, V. T.
1946. The biology and identification of trypetid larvae (Diptera: Trypetidae). Mem. Amer. Ent. Soc. 12: 161 pp.
Stone, A.
1951. The *Rhagoletis* of roses (Diptera, Tephritidae). Proc. Ent. Soc. Wash. 53: 45-48.